DEVELOPMENT AND IMPLEMENTATION OF A WEB-BASED GIS WITH APPLICATION TO THE EVALUATION OF EARTHQUAKE-TRIGGERED LANDSLIDES HAZARD AND RISK

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A web-based GIS is designed and implemented for the geospatial evaluation of earthquake-triggered landslide hazard and risk in El Salvador. The study of earthquake-induced landslides plays an important role in determining seismic risk, as earthquakes and landslides can result in considerable damage to infrastructure, in addition to a massive loss of life. The El Salvador GIS (SIGSAL) has been developed in the context of the ANDES and ANDROS projects as a development and implementation of a multidisciplinary methodology for the comprehensive landslide hazard assessment and analysis of catastrophic landslides in volcanic soils, financed by Ministry of Education and Science and Ministry of Science and Technology in Spain.

The geospatial database includes georeferenced thematic maps, graphical and numerical geospatial data, aerial and satellite images and hundreds of landslides with various sizes induced by the 13 January and 13 February 2001 earthquakes in El Salvador. These data are used to study existing hazard and susceptibility assessment methods. In addition, SIGSAL has allowed the analysis and the combination of various instability parameters related to phenomena in order to the susceptibility assessment (elevation, slope, aspect, terrain roughness, index of rainfall, land-use, etc.). From statistical and artificial intelligence techniques, as logistic regression (LR) and artificial neural network (ANN), we assess the susceptibility of earthquake-induced landslides for the whole country of El Salvador.

The triggering factor for landslides can be both heavy rain and earthquakes; other possible causes are anthropogenic, including deforestation, road cutting, and mining. In our work, only the earthquake is considered, since the inventory of landslides in relation to the 2001 earthquake was used. For incorporating the triggering factor, we used two methods: deterministic and probabilistic. In the deterministic model, an earthquake scenario is studied. However, in the probabilistic model a recent expected ground motion maps (in terms of peak ground acceleration, PGA with a 475-year return period) is used. This map was obtained from a cooperative project with researchers of different countries, such as the RESIS II project (financed by the Norwegian Government and managed by CEPREDENAC) for seismic hazard assessment of Central America.

The SIGSAL implementation on the web visualization tool is the solution for distributing mapping and GIS data and services on the Web. It will allow researchers to build efficient systems for handling, pre-processing, and analyzing the existing large datasets in the El Salvador region. In addition, the geographical data will be transferred to many concurrent users and allow them to do location- and attribute-based analyses. The process followed in order to develop this web information system consists in the spatial database development, an integrated earthquake-triggered landslide hazard an risk procedure design, and a web enabled data query and visualization tool set. The final application web map server will be used as an additional tool for risk and emergency assessment as well as for planning and decision making purposes.